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SCIENCE

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PLANS AND WORK AT CLARK UNIVERSITY.

THE commencement exercises of Clark University, which marked the opening of its second academic year, were held in the large hall of the university building, Oct. 4, 1890. About one thousand persons were present. Stephen Salisbury, Esq., presided, and made an opening address. The address of President G. Stanley Hall was as follows:—

"When called upon to consider the invitation with which the trustees of this university honored me, two and a half years ago, I was in an institution which, in the less than fifteen years of its existence, had done a work in stimulating other institutions, and in advancing the highest standards, which was, as I think all cheerfully admit, beyond comparison in the recent history of higher education in this country. After studying Worcester and the New England situation, I saw the opportunity here to be so great for a further and no less epoch-making step, that I felt that assured career, and even an important department, new in this country and full of fascinations, and in the most critical stage of its development, ought not to weigh against it. Permission was at once given me to begin my preparation for this important work by studying foreign institutions for a year. I visited every European country but Portugal, and found everywhere great and surprising advances since my own student life abroad had ended.

"In France the best and most original professors had been selected from among the various higher institutions of Paris (the Sorbonne, the College of France, Ecole Normale, and the great special institutes), and organized by the government into a new and still higher institution devoted to the most advanced work, and largely to research. This institution, the Ecole des Hautes Etudes, has some features of the French Academy, and adds to these lectures and the personal guidance and inspiration of the most advanced and able students from the other scientific institutions of the country. The new *conseil supérieur*, composed of statesmen and professors of the highest standing, which has the chief control of the national system of education from primary school to university, might almost be described as a new educational academy, with vast administrative responsibilities.

"The remarkable new school for the post-graduate training in statesmanship, which, although a private institution, is training the political leaders of all parties; the new law of 1878, basing all clinical and practical medical studies upon the sciences which underlie them (chemistry and the various branches of biology); the Musée Guimnet, which two years ago opened its extensive museums and libraries, and now offers facilities for the study of comparative religion un-

equalled in the world; the progressive decentralization and local organization of primary education (the sagacious policy of Minister Buisson); the development, by government and otherwise, of what may be called the pedagogy of high education; and the great fact that in fourteen years the total amount devoted to education in that country has increased sevenfold,—all this shows how far, in the words of a distinguished French statesman, 'education is fast becoming the central question for France.'

"In Italy a council of education, composed of sixteen royal appointees and sixteen professors selected from the universities, has grappled with the problem of subordinating fourteen of its universities to the other seven, which latter are being rebuilt with great and sometimes literally palatial magnificence. As, with the policy of doubling for each provincial university all the funds it can raise for itself, the government has gradually acquired practical control of all of them, scholarly and scientific activity has been awakened to new life in nearly all directions, and ambitions of intellectual leadership, as in the best days of the mediæval universities of Italy, are often manifest.

"Holland has revised and co-ordinated her organizations of higher education, and established one new university. Sweden has profoundly reconstructed her educational system on a plan that might be called the most severely modern in the world, and Denmark is taking steps in the same direction. In 1884, Russia, after prolonged discussion, re-organized her universities. In Great Britain, new provincial universities, and important changes in the others, too many and great to be briefly described here, have been inaugurated. In Germany, thirteen magnificent university buildings make Strasburg, in all departments, the best of all architectural embodiments of the German university ideal. Halle and Kiel have been, and Breslau is now being, almost entirely rebuilt. New and often magnificent laboratories, libraries, special cliniques, and museums at every seat of learning,—great temples of science, as they were called by one of its per fervid orators, Du Bois-Reymond,—and two single buildings costing four million dollars each, show where much of the French indemnity money has gone; and, what is far more important, the internal has not lagged behind the external growth. At Budapest, Ghent, Aix-la-Chapelle, Helsingfor in Finland, and even in remote Athens, magnificent new structures show in what esteem science is now held, and what still greater things she is yet expected to do. Several institutions of new pattern, like the Naples School of Zoölogy, which now trains the best professors for Germany; the London University, which is solely an examining body, and does not teach,—these and many more show not only how many and strong,

but how differentiated, institutions have become in the field of higher education.

"In my trip, information was sought from every source. Books, reports, and building-plans of many kinds were gathered. Ministers of education, heads of universities, and, above all, leading scientific men, were visited. The information and advice of the latter, always cheerfully given, and in not a few cases in detail and in writing, constitute by far the most valuable result of this trip, and will soon be reported on at greater length. Much of this advice was confidential, and involved personalities; some of it embodies long and fondly cherished ideals of great men, nowhere yet realized; but most of it represents the inner aims, methods, and ideals of the best existing institutions, like those named above, and others.

"The causes and the effects of all these movements and ideals in Europe have been felt in other lands. After long discussion, a new university, to which hundreds of Russian patriots with exiled friends have contributed money, household treasures, and even prayers and tears, was at last founded in Siberia, at Tomsk, and not at either of the chief military centres, where freedom would have been impossible. In Japan one of the most interesting universities in the world has been developed as the centre and instrument of most of the remarkable transformation in that country. In Australia and South America new and vigorous universities have been recently established.

"The new movement is already upon us in this country, and many significant facts show that the resultant interest and opportunity here have never been so great. All such facts and tendencies, and many more, opened a clear and broad field for us at Worcester, and unmistakably defined our work as follows:—

"1. It must be of the highest and most advanced grade, with special prominence given to original research. This our country chiefly lacks and needs for both its material and educational welfare. This is in the current of all the best tendencies in the best lands, and is the ideal to-day of, I believe, about every scientific man, who is able and in earnest, throughout the world. For this our location offers the rarest opportunities and inducements yet possible in this country.

"2. We must not attempt at once to cover the entire field of human knowledge, but must elect a group of related departments of fundamental importance, and concentrate all our care to make these the best possible. Each science has become so vast and manifold that it is impossible to cultivate the frontier of all at a single university. This is more and more recognized abroad, and is still more true under our American system of private endowment than on the European plan, with a national treasury to draw from. If coming universities, instead of supplementing others, will elect each its group of studies, all the gain in economy and effectiveness which skilled labor has over unskilled will be secured in the field of highest education.

"3. For our group we chose at first five fundamental and related sciences. Work in science can be quickest organized. Great libraries and museums, and every thing else that only age can bring, can be dispensed with at first, and a complete outfit of the best apparatus and of all needed books can be gathered in a short time. Again, this is a practical country, and its industries are sure to depend more and more on the

progress of science. So far, we have utilized science with extraordinary ingenuity in our inventions, but have done comparatively little to create or advance it. We desired to make a patriotic endeavor to develop American discoverers as well as inventors. Finally, and above all, science, with its modern methods, has become an unsurpassed school of discipline, culture, and reverence.

"4. We must seek the most talented and best trained young men. We must not exploit them, work them in a machine, nor retard their advancement, but we must give them every needed opportunity and incentive. As from hundreds of applicants we have admitted but a very few of the best students, because many would frustrate our plan, so, from the many subjects found in most large universities, we selected five to receive all our care, although later we hope to increase both.

"Mathematics is often called the queen of all the sciences. As the latter become exact, they approximate it, and are fructified by its spirit and its methods. Its antiquity, its disciplinary value, its rapid and recent development, make it obviously indispensable. Physics is the field of the most immediate application of mathematics, and deals with the fundamental forces of the world,—heat, sound, light, electricity,—and the underlying problems of form and motion generally, with their vast field of application in such sciences as astronomy and dynamic geology. Chemistry, with its great sudden development, revealing marvellous order and harmony in the constitution of matter, is rapidly extending its dominion over industrial processes. Biology, which seeks to fathom the laws of life, death, reproduction, and disease, that underlies all the medical sciences, in its broader aspects has taught man in recent decades far more concerning his origin and nature than all that was known before. Psychology, or the study of man's faculties and their education, is a new field into which all sciences are now bearing so many of their richest and best ideas, and now so full of promise of better things for the life of man. These five we must have, and nowhere is man brought so close to the primitive revelation of God in his works.

"We have thus sought in these departments the highest form of what is called the philosophical faculty, devoted to non-professional specialization. We are not a graduate department in which most so called graduate students attend, and most professors conduct undergraduate work. We are not an institution like the Smithsonian, which does no teaching; but our teaching is so ordered that it is a direct stimulus to research, and no one is so able and eager to teach the few fit as a discoverer. We are not an academy of sciences, but we have features of all these, and many more. This work is the most laborious and the most expensive. It is the most all-conditioning and the most central for any and every new departure. An undergraduate department, a medical school, a technical school, and, even still more, specialization in the existing departments, or new ones of any kind, could be developed from this basis with comparatively little labor, time, or expense. But the value of all professional or industrial schools depends on the vigor and dominion of the philosophical faculty, the heart of every true university, from which they derive their life and light, and where knowledge is pursued for its own sake, and for its culture effect on the investigator. We are a school

for professors, where leisure, method, and incentive train select men to higher and more productive efficiency than before.

"Last year college trustees elsewhere found a full half-dozen of our fellows only too attractive for their vacant chairs. But if we can thus relieve college trustees of the difficulties under which they sometimes succumb, in selecting suitable men for professorships, we can also ease them of the great expense of providing advanced courses, and from the temptation of retaining after graduation their best men, who could and should utilize larger opportunities.

"The work of the university began a year ago, in all its departments. During the first part of the year, the work of furnishing and equipment was carried on side by side with lectures and scientific work. Our nearly threescore men (selected in part only from about nine hundred applicants for various positions) included graduates of forty-eight different universities and colleges. The printed register describes the buildings, grounds, and organization of the faculty; the system of docents and fellowships; methods and courses of instruction; and the scientific and literary equipment of each department. During the year twenty-eight professors and other instructors have given thirty-three courses, attended often by other professors. This method of mutual instruction has proven a great and wholesome stimulus.

"In our methods of instruction, stated lectures, which are required by the vote of the trustees, are the smallest part. Elbow-teaching is given in the laboratory, and there is individual and constant guidance of reading, as well as experimentation, if needed or desired. Clubs, conferences, and seminaries are held, where all important literature in a wide field, and in different languages, is read; each man taking a subject, and reading and reporting for the benefit of others. Not only the information, but the insight, criticism, methods, and standpoint of each are pooled for the edification and stimulation of all. The contact between professor and student was never closer, and more avenues were never opened between minds working in the same place and field.

"The most important part of our work is research, and we wish soon to be ready to be chiefly judged by the value of our contributions to the sum of human knowledge. By the unanimous vote of the board of trustees, approved by a unanimous vote of the faculty, the leading consideration in all engagements, re-appointments, and promotions, must be the quality and quantity of successful investigation. This significant step gives us a unique character, and makes most of our problems new ones.

"It seems, and often is, a very simple and easy thing to take a free look at new facts. This kind of investigation may be made by any traveller or intelligent collector of specimens. It is sometimes harder to slightly vary the conditions in well-known fields, and note the concomitant variations in the result. Both these kinds of work are, in a sense, original research. Such are many of the theses for the doctor's degree, not to speak of those that are not published; so that the work of the professors and the students, and the standing of the university and the value of its degree, are unknown. Results must be had without risk of failure. Very different from and above this and all so-called 'analogy-work' are the investigations conducted by the aid of accom-

plished experts, who have already taken their doctor's degree, and give their entire time to co-operation with the professors. Of these we have had one or more in each experimental department during the year, and with excellent results, for investigation. Risks of negative results, often very important in themselves, must be freely taken, if results of great value are to be attained.

"It is impossible, in untechnical terms, to even speak of the researches undertaken here during the year, although these are the chief work of the university. New minerals in Arkansas, with a book on the petrography of that State; chemical action as affected by electricity in the field of a strong magnet; the crystal structure of isomorphous compounds; the ultimate atomic and molecular constitution of two widely different groups of chemical substances, which is said to establish new and important scientific conclusions; further developments of the non-euclidean geometry; several papers, said to be of great algebraic importance, on matrices; a standard of length in terms of a light-wave one fifty-thousandth of an inch long; a new method of greatly magnifying the power of telescopes, so that possibly the disks of fixed stars may be seen (a method speedily put in operation by the Lick Observatory, with the largest telescope glass in the world); the electrical properties of the air, and a little group of problems in meteorology; the embryology of an animal peculiar to America, and of great importance to the ancestry of vertebrate life; studies of sea-anemone and jelly-fishes; the breeding-habits and embryology of the lobster, strangely unknown before; a third fundamental tissue determined for most organs in the vertebrate body; the discovery of the innervation of veins; the comparative study of organs of taste in many vertebrates; fatigue, studied experimentally and also histologically, in the living cell; the brain of the world-known deaf-mute, Laura Bridgman, more thoroughly studied than any brain ever before has been; the time of the quickest mental and nerve processes; the sense of rhythm, so fundamental to several arts; the myths, customs, and beliefs of the native Indian tribes of British Columbia,—all of these and half a dozen more of less significance, some not yet completed, some already published in several languages, represent some of our work here during the past year, so important that if, instead of marking the beginning of a second year with greater facilities and increased numbers and zeal, this occasion marked the close of the university, the sum of human knowledge would have been larger for our having existed, and we should have our place forever in the history of the advancement of science.

"In addition to this, I do not here mention the marked stimulus we have already exerted on other institutions. In this new country we need new men, new measures, and occasionally new universities; and we, like England, have in later years experienced their amazing good. In the field of experimental science, unlike some other departments, what is there of importance, that a few centuries can afford, that cannot be at least as well provided in a few years? A new institution, in a time and place like the present, manned by young men, ought to become a new movement. Many of our problems are new in this country, and must be wrought out slowly and in the light of all available experience and wisdom.

"Partly to aid ourselves in this work, as well as for our

students, we attempt this year to begin to develop the pedagogy of higher education by a new department, and a new third journal, now about to be issued from the university.

"Finally, although we yet lack all the traditions and enthusiasm that come with age, with what gratitude and earnest felicitation does every mind and heart here turn to a founder who is not a tradition, a picture, a statue, or even a memory, but the living, animating power of the institution he has planted with such wisdom, and watered with such care! As an investigator toils to bless mankind with new discoveries, so he has wrought that the world might be blessed by the more rapid increase and diffusion of truth. As a teacher longs to impart all his knowledge to a favored pupil, so he has been the best of all my teachers in things in which a scholar may sometimes lack wisdom. As parents are anxious for the comfort and highest success of all their children, so he, and his devoted wife, could even be careless of what all others may say or do, if only every man here be so placed, furnished, and incited as to do the best work of which he is capable, for himself and for science. If we labor with his persistence and devotion, his care in things that are small as well as great, we cannot fail to realize his and all our highest hopes and best wishes for Clark University."

THE ARYAN CRADLE-LAND.¹

"It will be for the benefit of our science," said the president of the Anthropological Section of the British Association, "that speculations as to the origin and home of the Aryan family should be rife; but it will still more conduce to our eventual knowledge of this most interesting question if it be consistently borne in mind that they are but speculations." With the latter, no less than with the former opinion, I cordially agree. And as, in my address on the Aryan cradle-land in the Anthropological Section, I stated a greater variety of grounds in support of the hypothesis of origin in the Russian steppes than has been elsewhere set forth, I trust that I may be allowed briefly to formulate these reasons, and submit them to discussion.

(1) The Aryans, on our first historical knowledge of them, are in two widely separated centres,—Transoxiana and Thrace. To Transoxiana as a secondary centre of dispersion the eastern Aryans, and to Thrace as a secondary centre of dispersion the western Aryans, can, with more or less clear evidence or probable inference be traced, from about the fourteenth or perhaps fifteenth century B.C.; and the mid-region north-west of Transoxiana and north-east of Thrace—and which may be more definitely described as lying between the Caspian and the Euxine, the Ural and the Dnieper, and extending from the 45th to the 50th parallel of latitude—suggests itself as a probable primary centre of origin and dispersion.

(2) For the second set of facts to be considered reveal earlier white races, from which, if the Aryans originated in this region, they might naturally have descended as a hybrid variety. Such are the facts which connect the Finns of the north, the Khirgiz and Turkomans of the east, and the Alarodians of the south with that non-Semitic and non-Aryan white stock which has been called by some Allophylian, but which, borrowing a term recently introduced into geology, may, I think, be preferably termed Archaian; and the facts which make it probable that these white races have from time immemorial met and mingled in the South Russian steppes. Nor, in this connection, must the facts be neglected which make great environmental changes probable in this region at a period possibly synchronous with that of Aryan origins.

(3) In the physical conditions of the steppes characterizing the region above defined, there were, and indeed are to this day, as has been especially shown by Dr. Schrader, the conditions neces-

sary for such pastoral tribes as their language shows that the Aryans primitively were; while in the regions between the Dnieper and the Carpathians, and between the Oxus and the Himalayas, the Aryans would, both in their south-western and south-eastern migrations, be at once compelled and invited, by the physical conditions encountered, to pass at least partially from the pastoral into the agricultural stage.

(4) The Aryan languages present such indications of hybridity as would correspond with such racial intermixture as that supposed; and in the contemporary language of the Finnic groups Professor De Lacouperie thinks that we may detect survivals of a former language presenting affinities with the general characteristics of Aryan speech.

(5) A fifth set of verifying facts are such links of relationship between the various Aryan languages as geographically spoken in historical times,—such links of relationship as appear to postulate a common speech in that very area above indicated, and where an ancient Aryan language still survives along with primitive Aryan customs: for such a common speech would have one class of differentiations on the Asiatic, and another on the European side, caused by the diverse linguistic re-actions of conquered non-Aryan tribes on primitive Aryan speech, or the dialects of it already developed in those great river partitioned plains.

(6) A further set of verifying facts are to be found in those which lead us more and more to a theory of the derivative origin of the classic civilizations, both of the western and of the eastern Aryans. Just as between the Dnieper and the Carpathians, and between the Oxus and the Himalayas, there were such conditions as must have both compelled and invited to pass from the pastoral into a partially agricultural stage, so, in passing southward from each of these regions, the Aryans would come into contact with conditions at once compelling and inviting to pass into a yet higher stage of civilization. And in support of this all the facts may be adduced which are more and more compelling scholars to acknowledge that in pre-existing Oriental civilizations the sources are to be found, not only of the Hellenic and the Italic, but of the Iranian and the Indian civilizations.

(7) Finally, if the Hellenic civilization and mythology is thus to be mainly derived from a pre-existing Oriental or "Pelasgian" civilization, it is either from such pre-existing civilizations, or from Aryans such as the Kelto-Italiots, migrating northward and southward from Pelasgian Thrace, that the civilization of western and northern Europe would, on this hypothesis, be traced: and a vast number of facts appear to make it more probable that the earlier civilization of northern Europe was derived from the south than that the earlier civilization of southern Europe was derived from the north.

The three conditions of a true solution of the problem either of Semitic or of Aryan origins appear to be these: first, the locality must be one in which such a new race could have ethnologically, and secondly philologically, arisen as a variety of the Archaian stock of white races; and, thirdly, it must be such as to make easily possible the historical facts of dispersion and early civilization. And I venture to submit the above sets of facts as not inadequately, perhaps, supporting the South Russian "speculation as to the origin and home of the Aryan family."

J. S. STUART GLENNIE.

ETHER INTOXICATION.

WE can bear out from personal observation, says the *Lancet* for Sept. 20 editorially, many of the statements which are now going the round of the public press in reference to the habit of ether-drinking in some parts of Ulster; for, in fact, some of the paragraphs are nothing more than copies of what have been reported in years gone by. The practice came into use about the year 1841-42, and was at first a kind of re-action against the great temperance movement which had been inaugurated by Father Mathew. Ether, at that time of the ethylic type, probably not very pure, was substituted for whiskey; and the habit, commencing in or near to Drapers Town and spreading over a small surrounding area, is continued up to the present day. The order of drinking, as witnessed during a visit to the district named, is singular. The

¹ From *Nature* of Oct. 2.